

Impact Cratering in the Solar System



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HEAVEN
AND EARTH
ARE ABOUT TO
COLLIDE

DEEP
IMPACT
SUMMER 1998

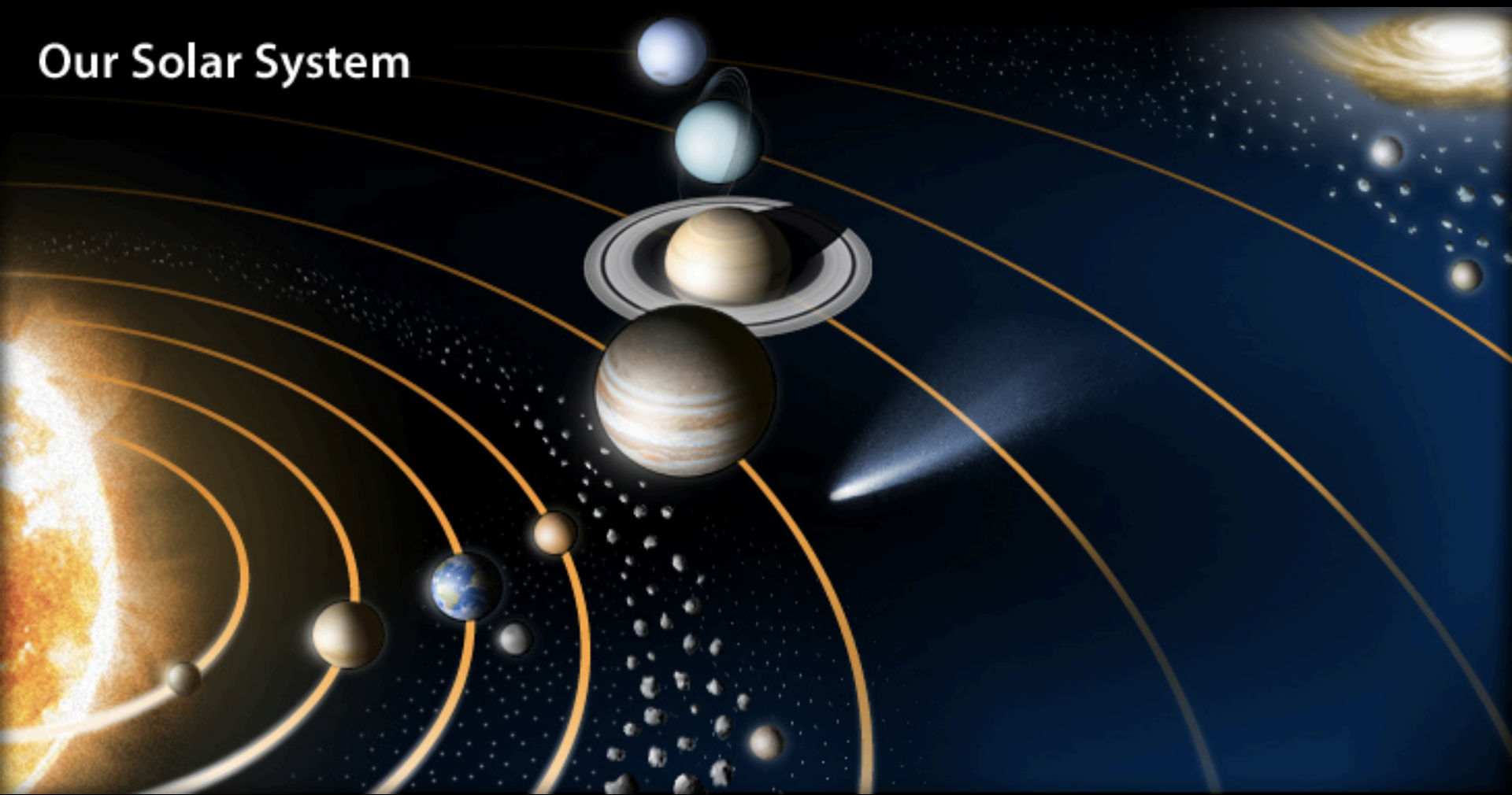
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Paramount Pictures,
Dreamworks

Our Solar System





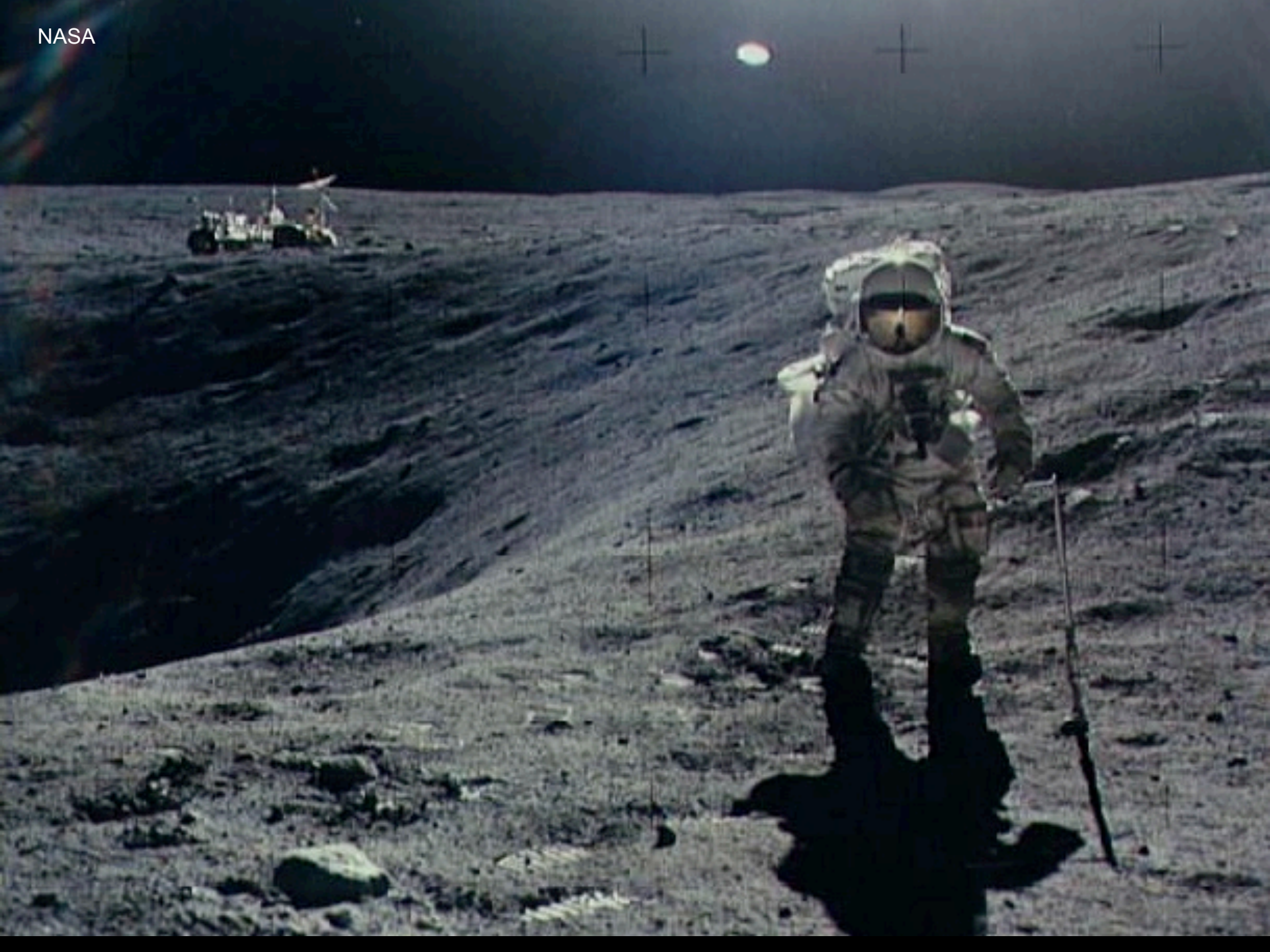
NASA

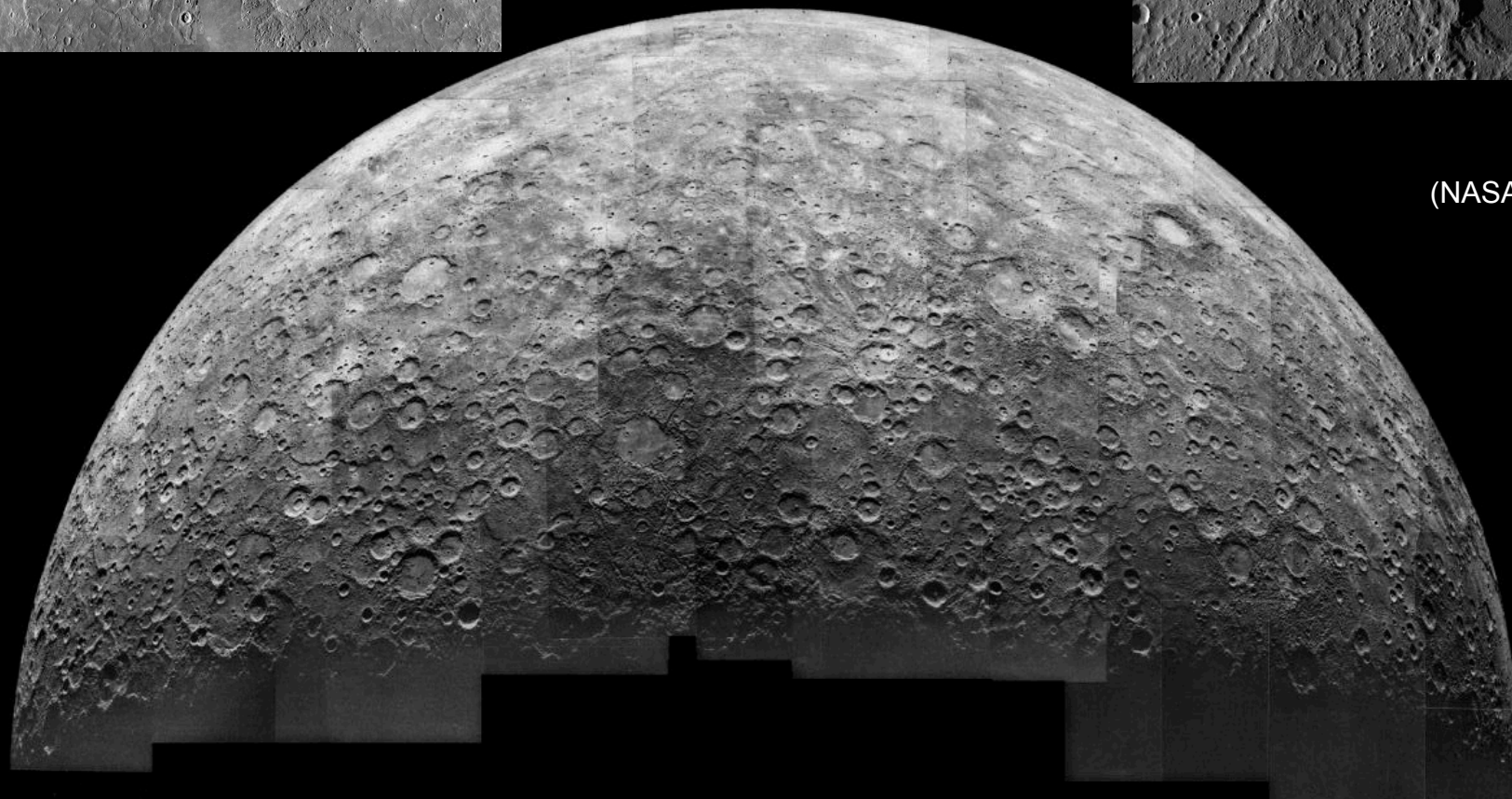
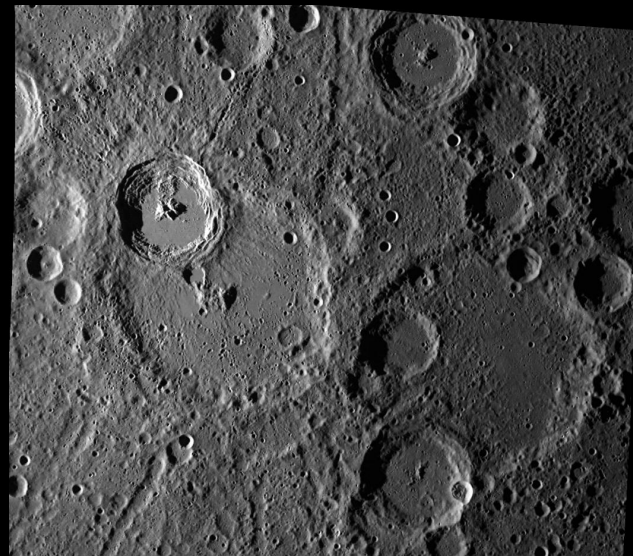
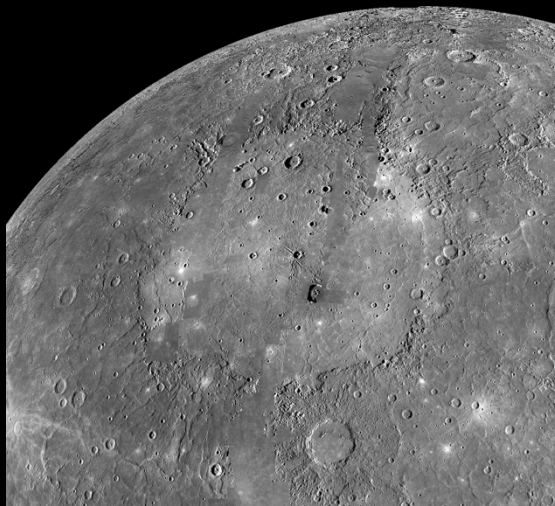
Bullialdus to Schiller

BOB OLSON

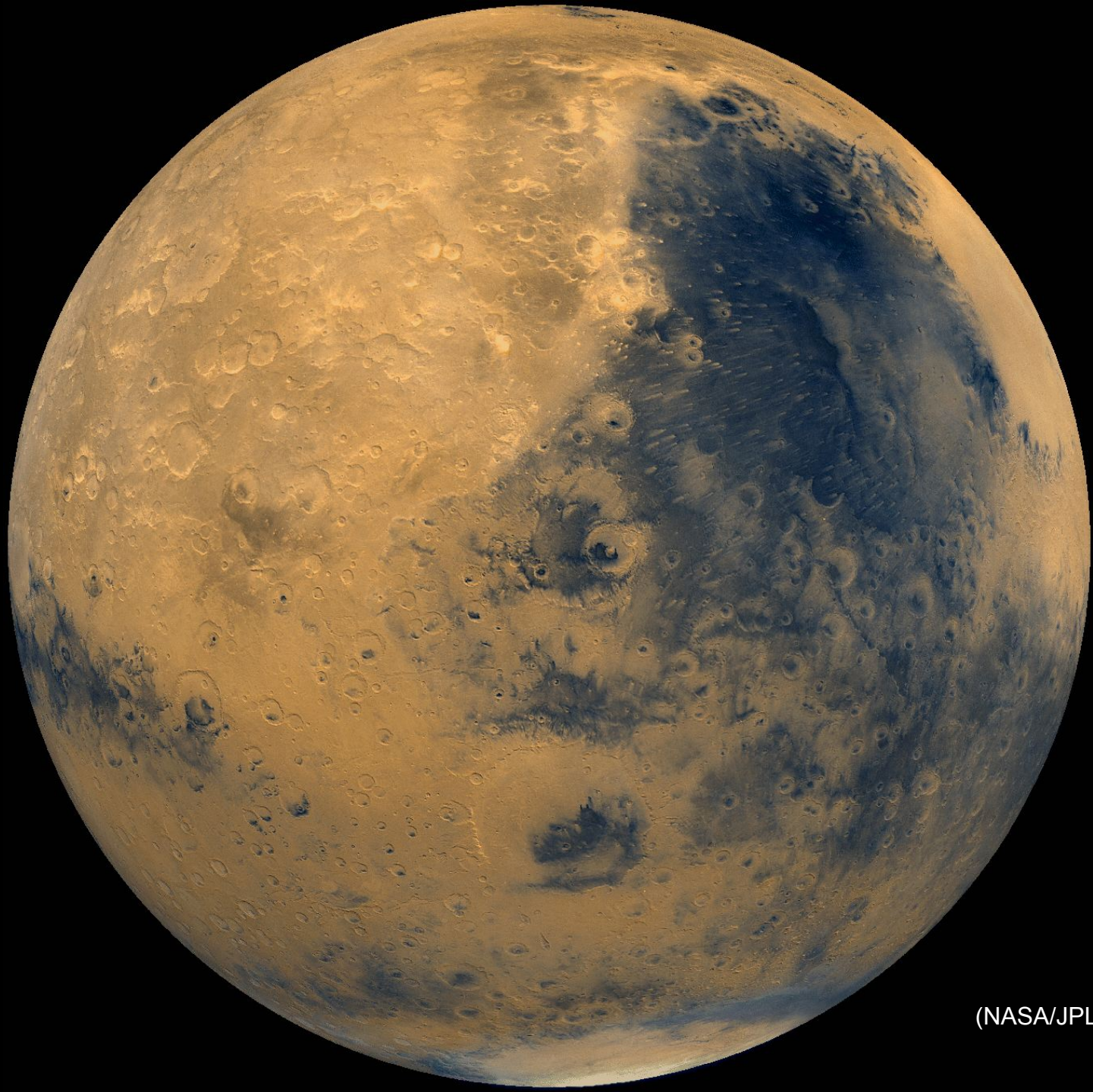


NASA





(NASA/JPL)



(NASA/JPL)

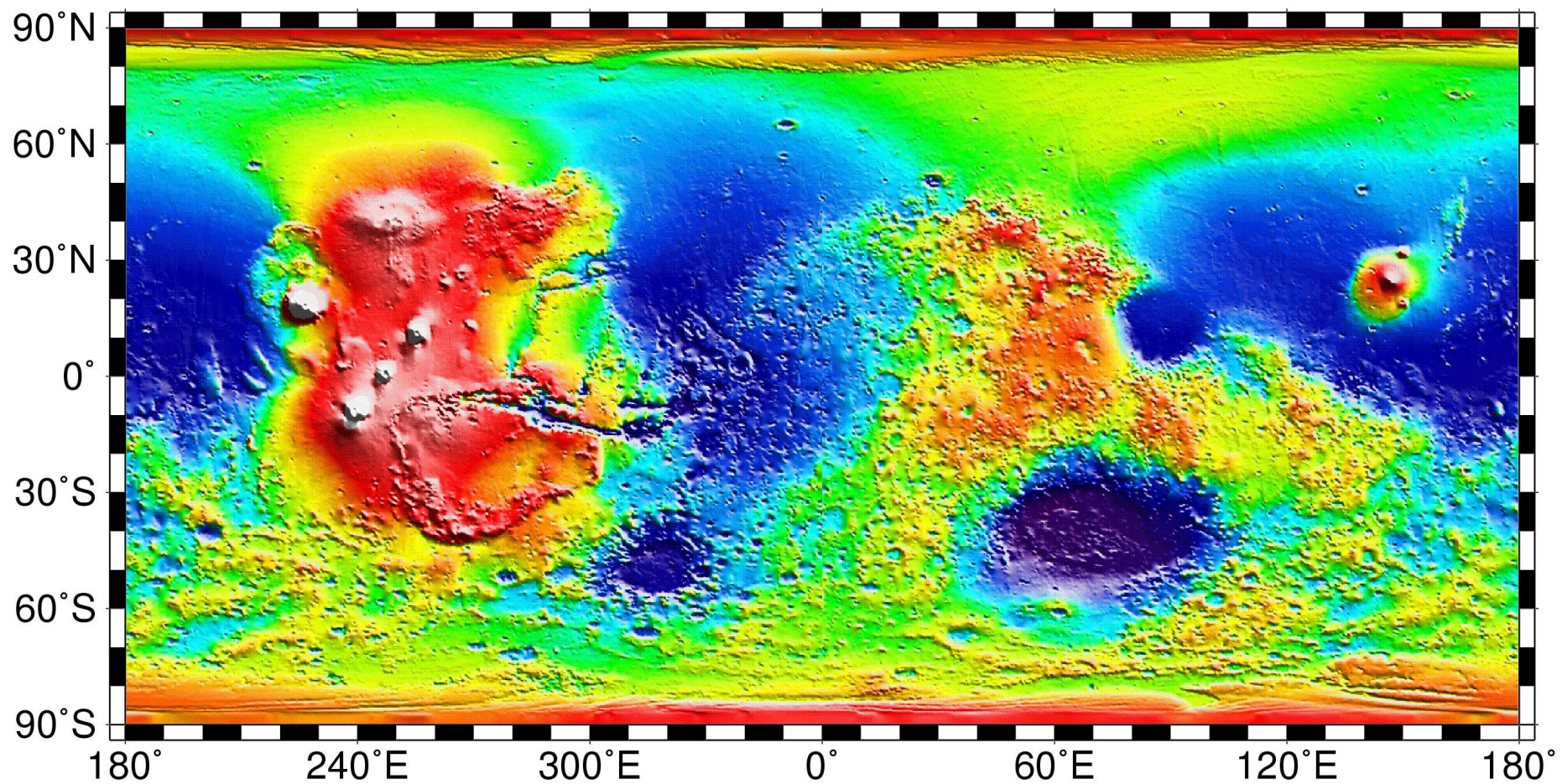
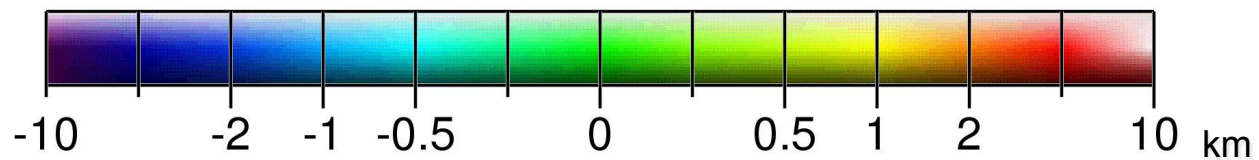
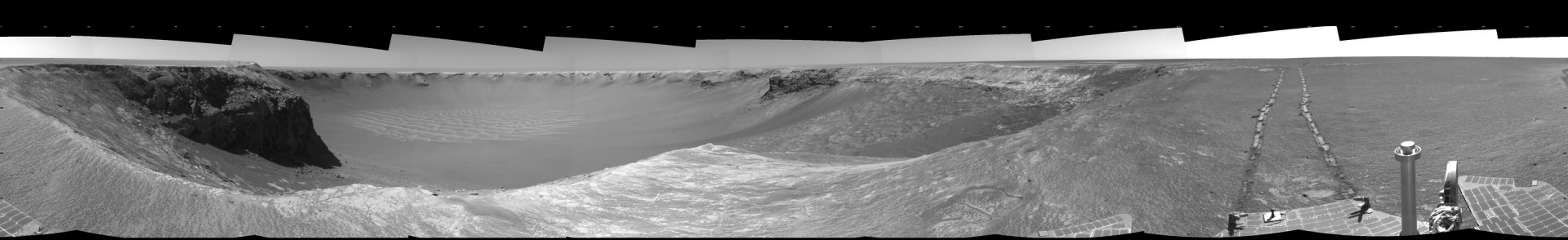


Image: NASA/JPL/MSSS



NASA/JPL-Caltech

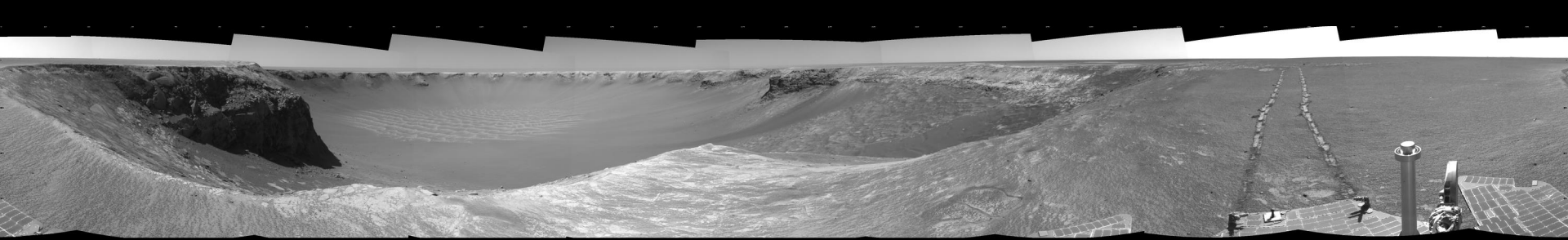


Image: NASA/JPL-Caltech



Images: NASA/JPL/UA

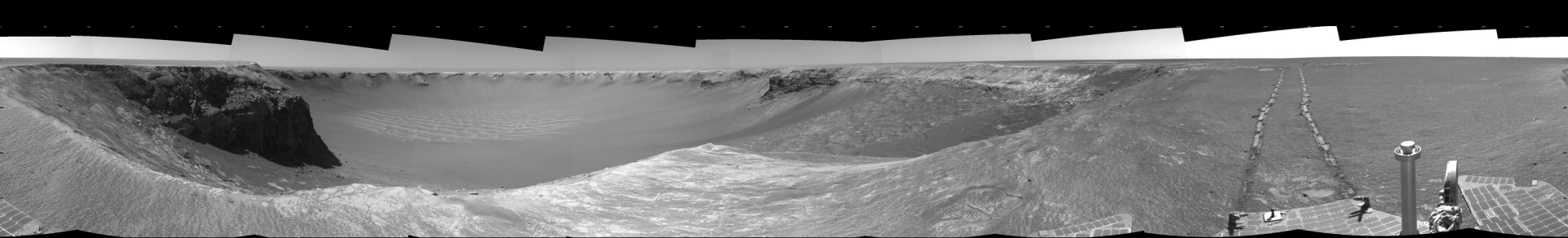
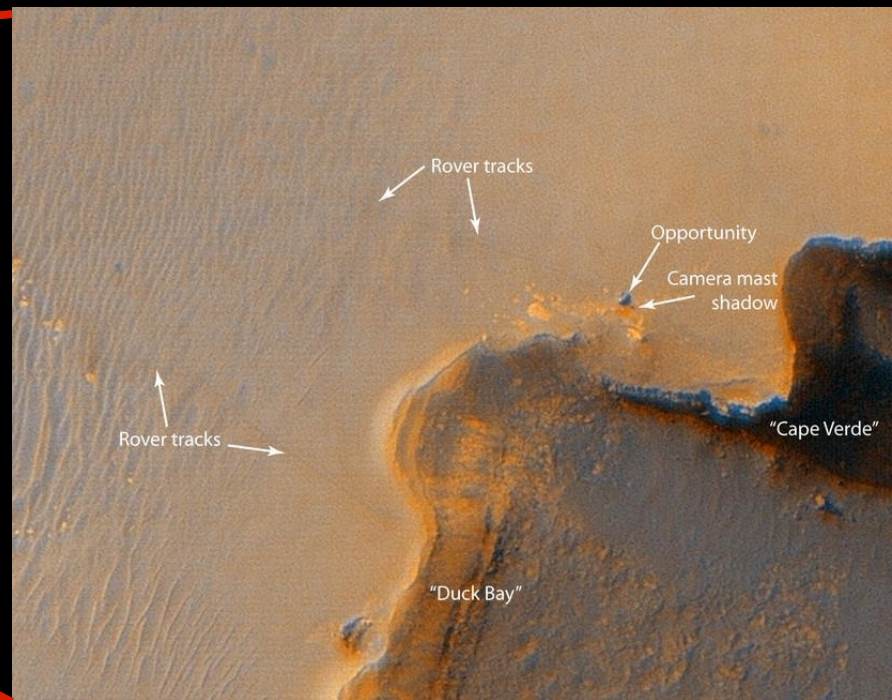
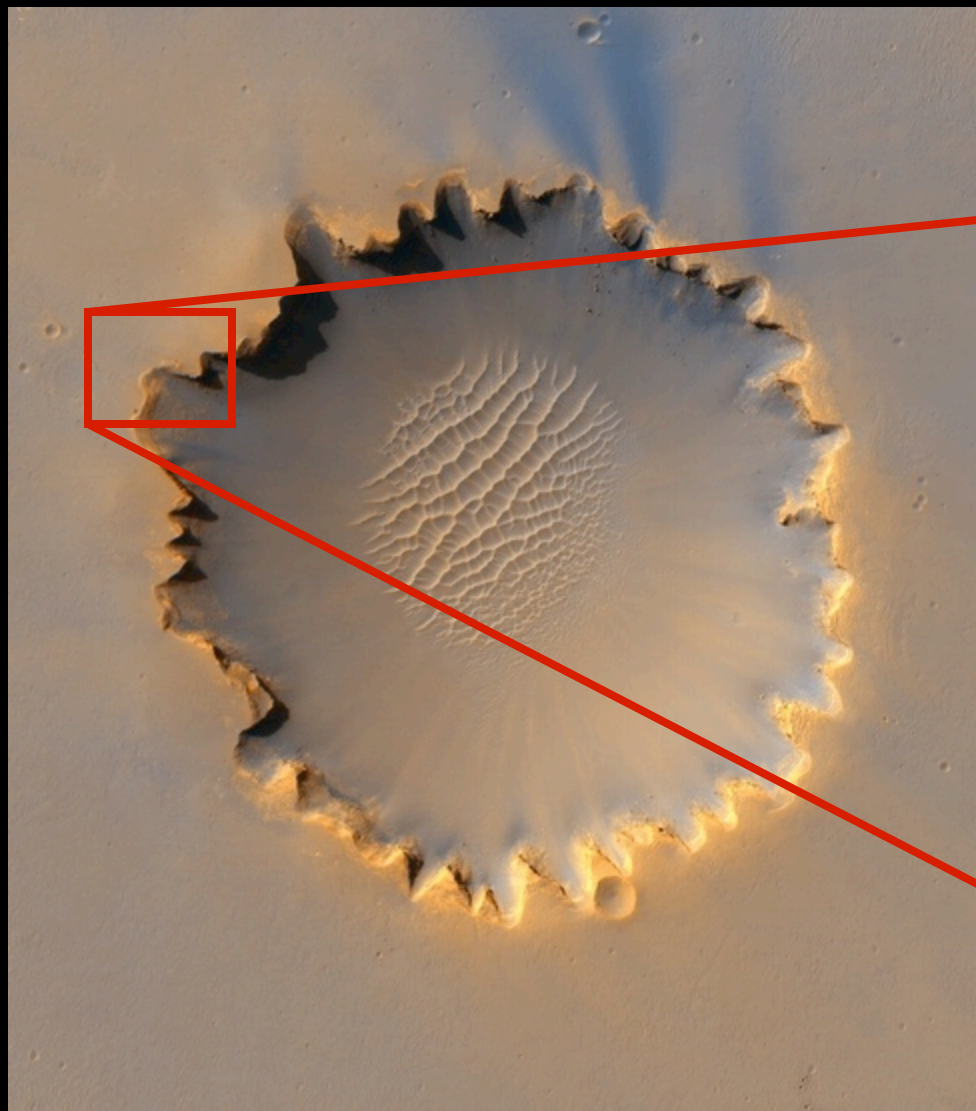
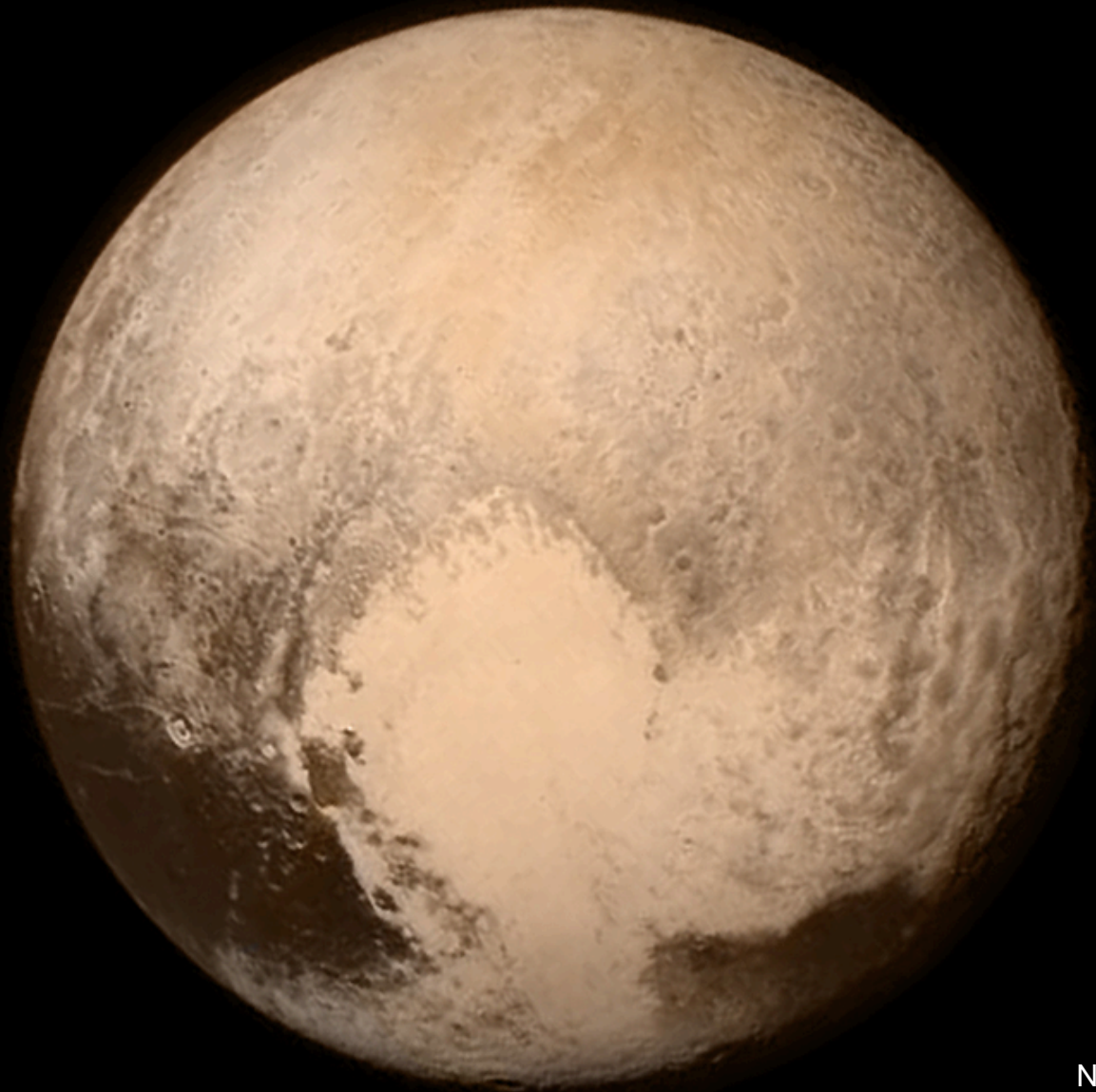


Image: NASA/JPL-Caltech



Images: NASA/JPL/UA



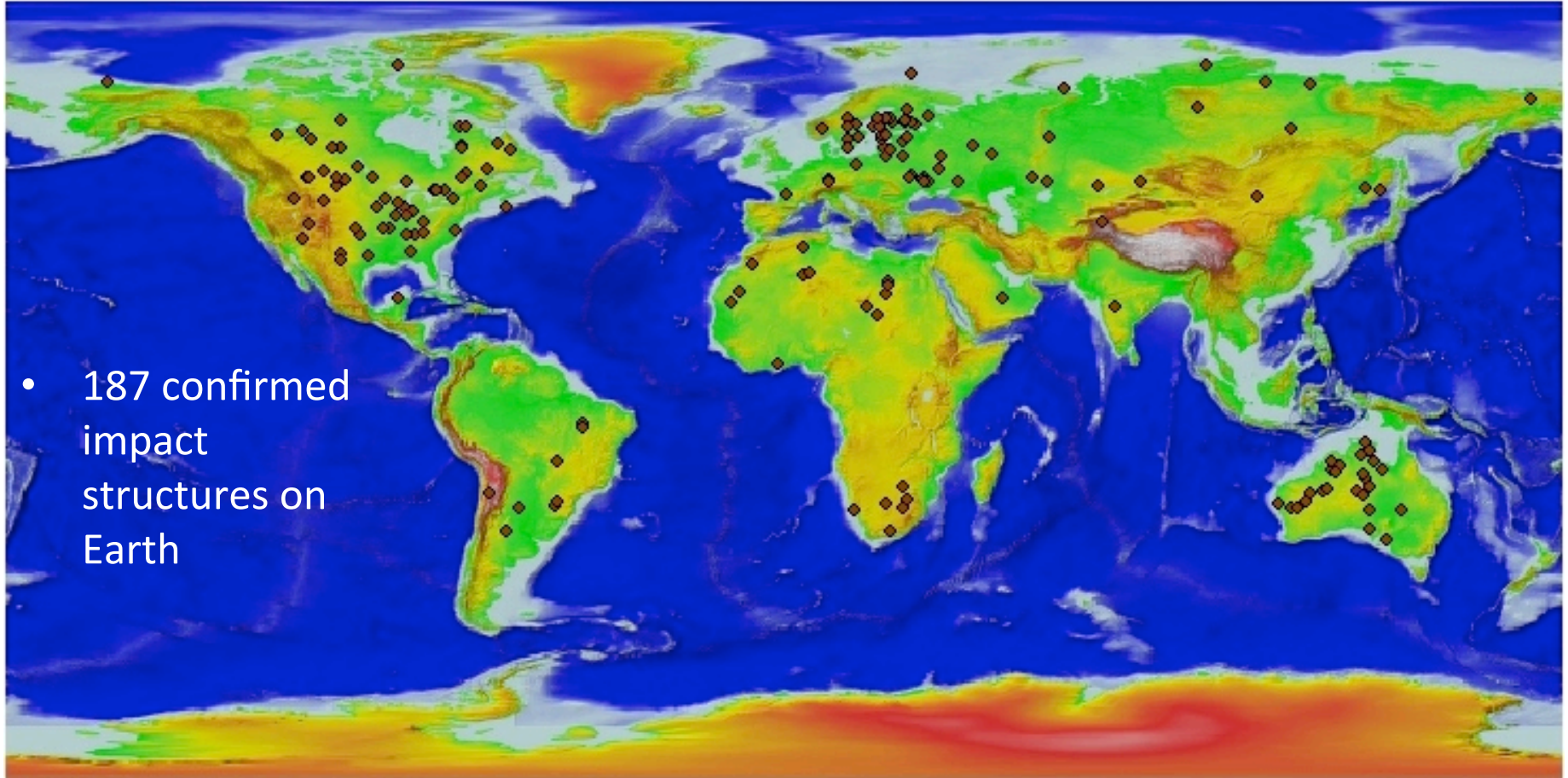
NASA/APL/SwRI



NASA: Apollo 17



- 187 confirmed impact structures on Earth





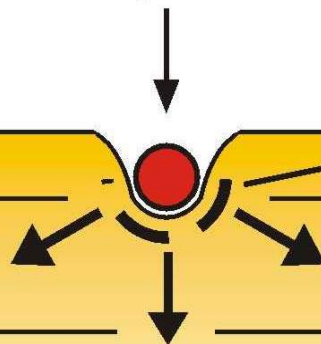






Projectile

Shock wave



Contact/compression stage

Ejecta

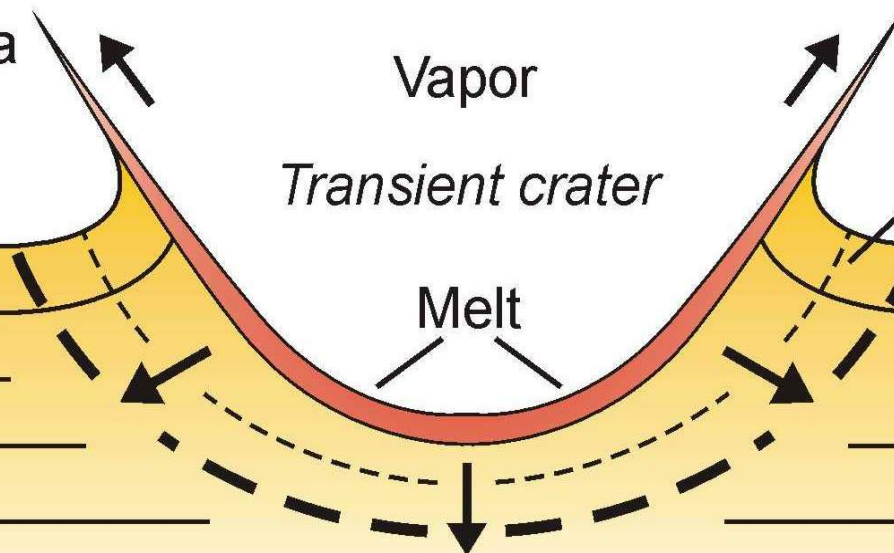
Vapor

Transient crater

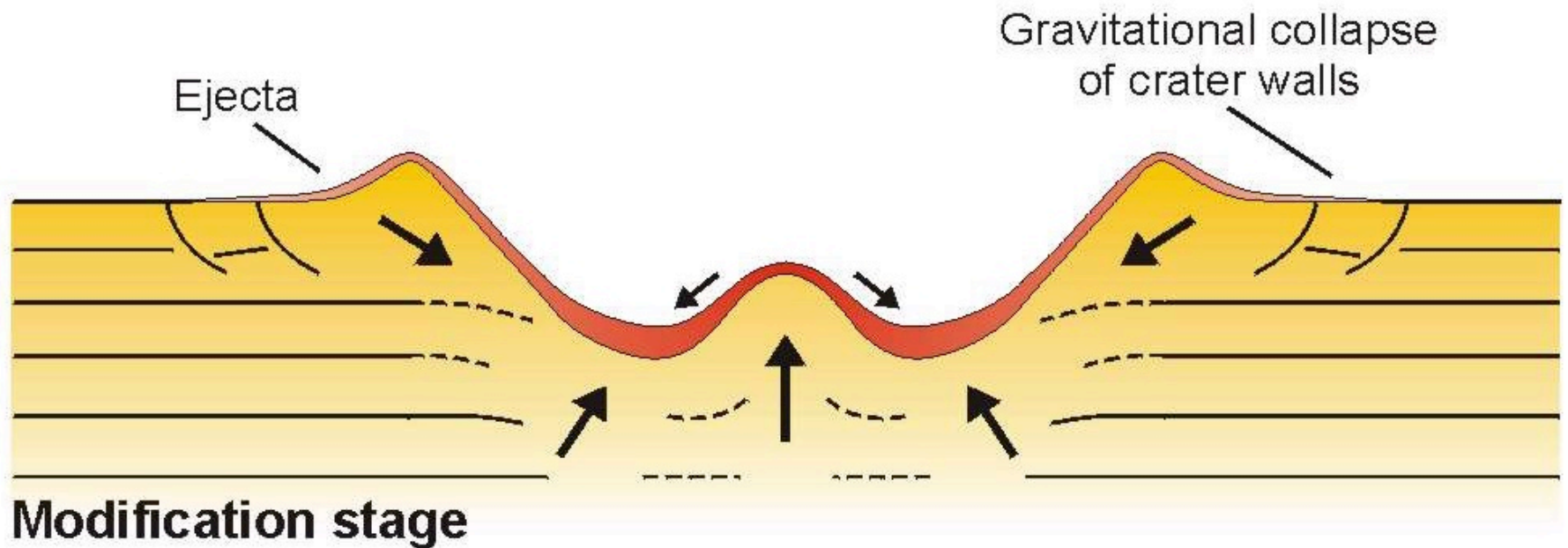
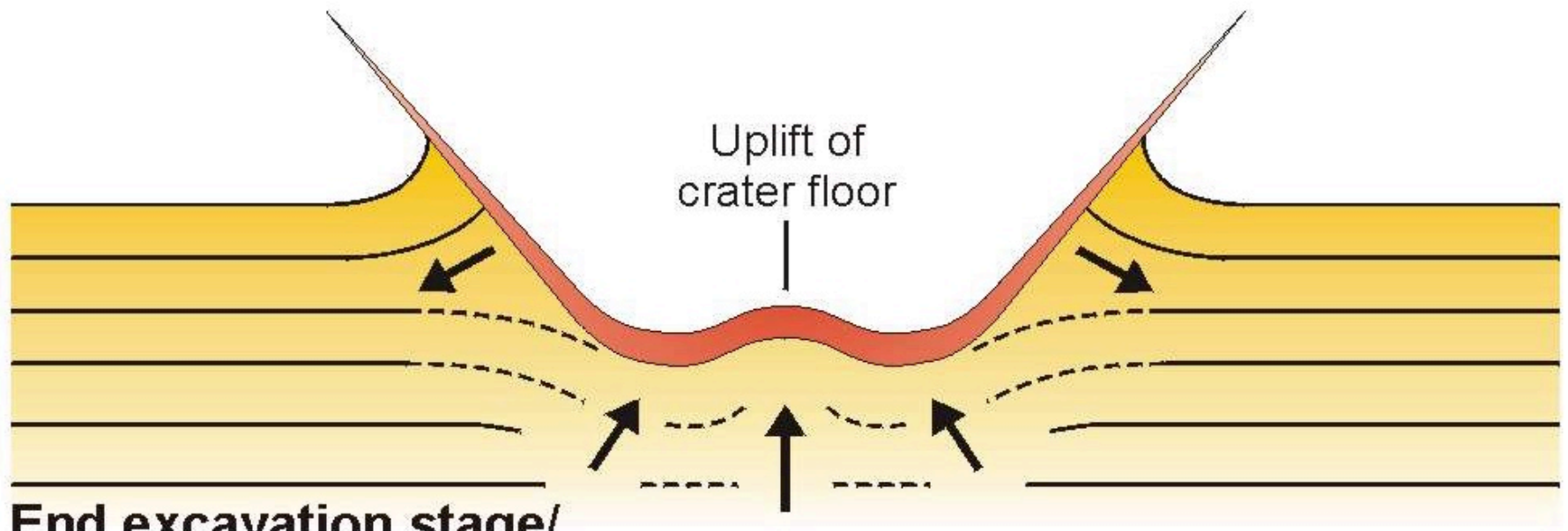
Melt

Rarefaction or
"release" wave

Shock wave



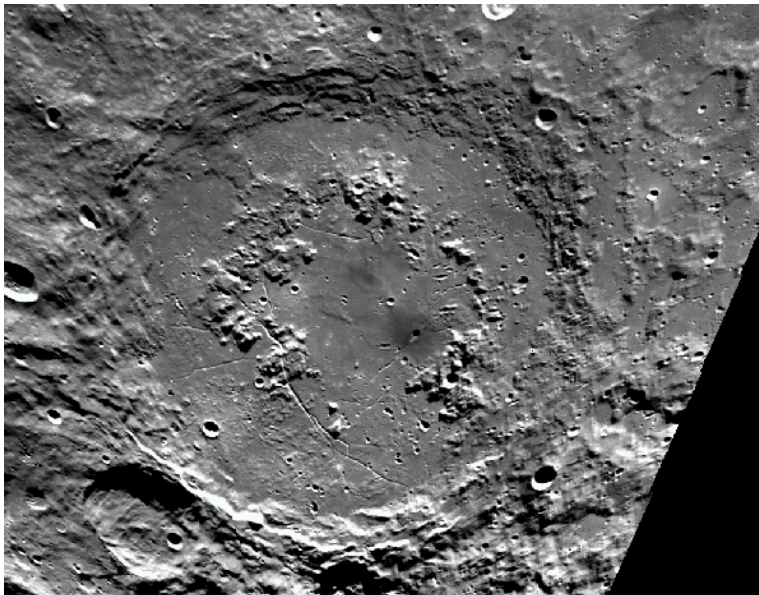
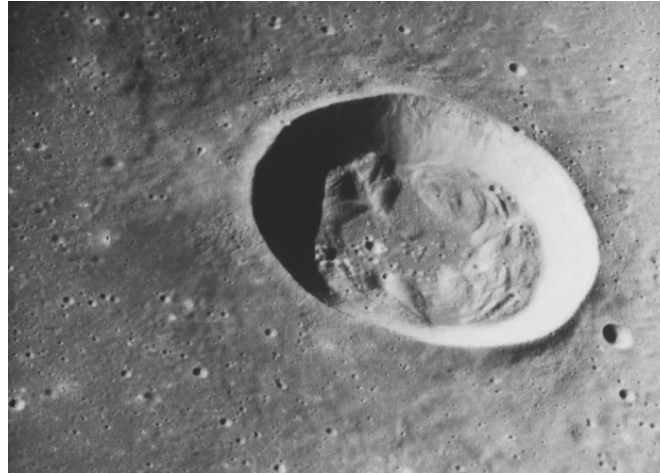
Excavation stage





Moltke Crater (d = 7 km);
Apollo 10 photograph
AS10-29-4324

Bessel Crater (d = 16 km); Part of Apollo 15
Panoramic photograph AS15-9328



Schrodinger Crater (d = 320 km); Mosaic of Clementine
images. Image processing by Ben Bussey



Euler Crater (d = 28 km);
Apollo 17 Metric
photograph AS17-2923

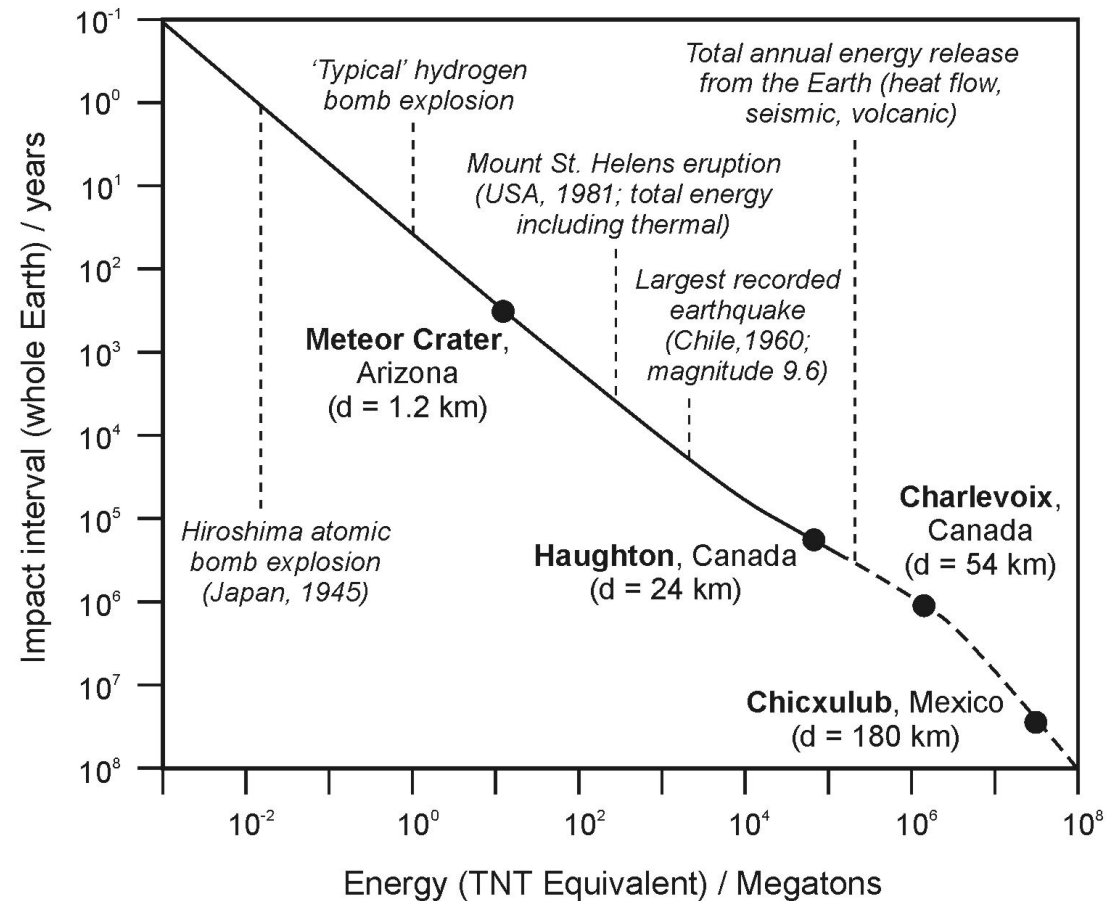
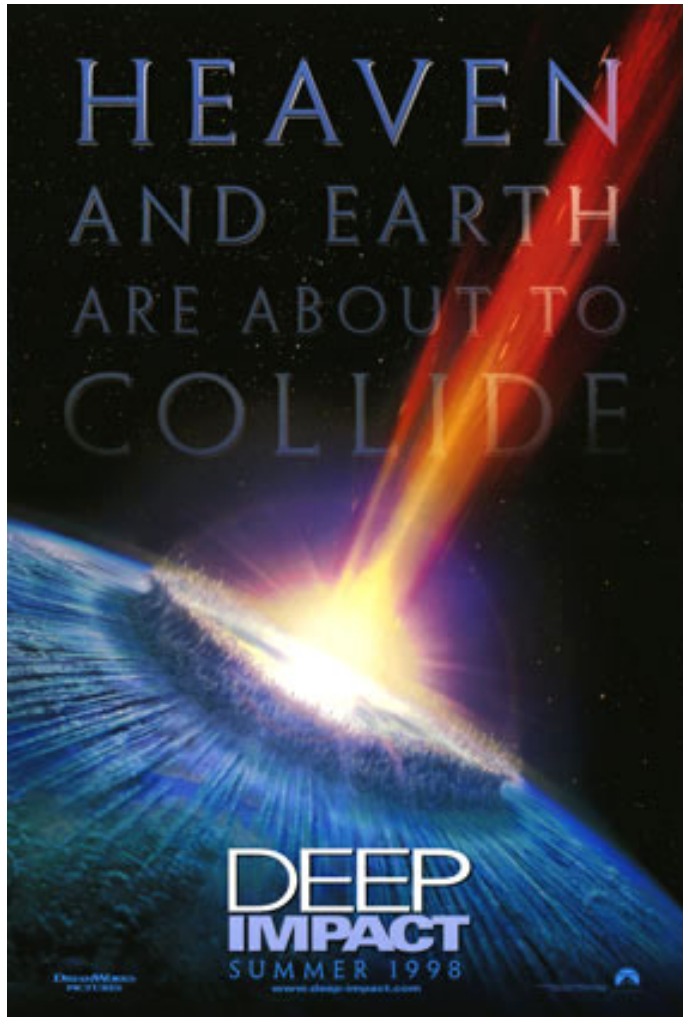


Artwork: D. Davies



J. Tucciarone

The destructive power of impact events



Data from French (1998)

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WHO ARE YOU?

PERSONALITY Towards a grand unified theory

IDENTITY The essential elements of self

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Impact-generated
hydrothermal
systems
(& their weathering
products)

Impact-processed
crystalline rocks



Impact-generated
glasses

Impact-generated
crater lakes



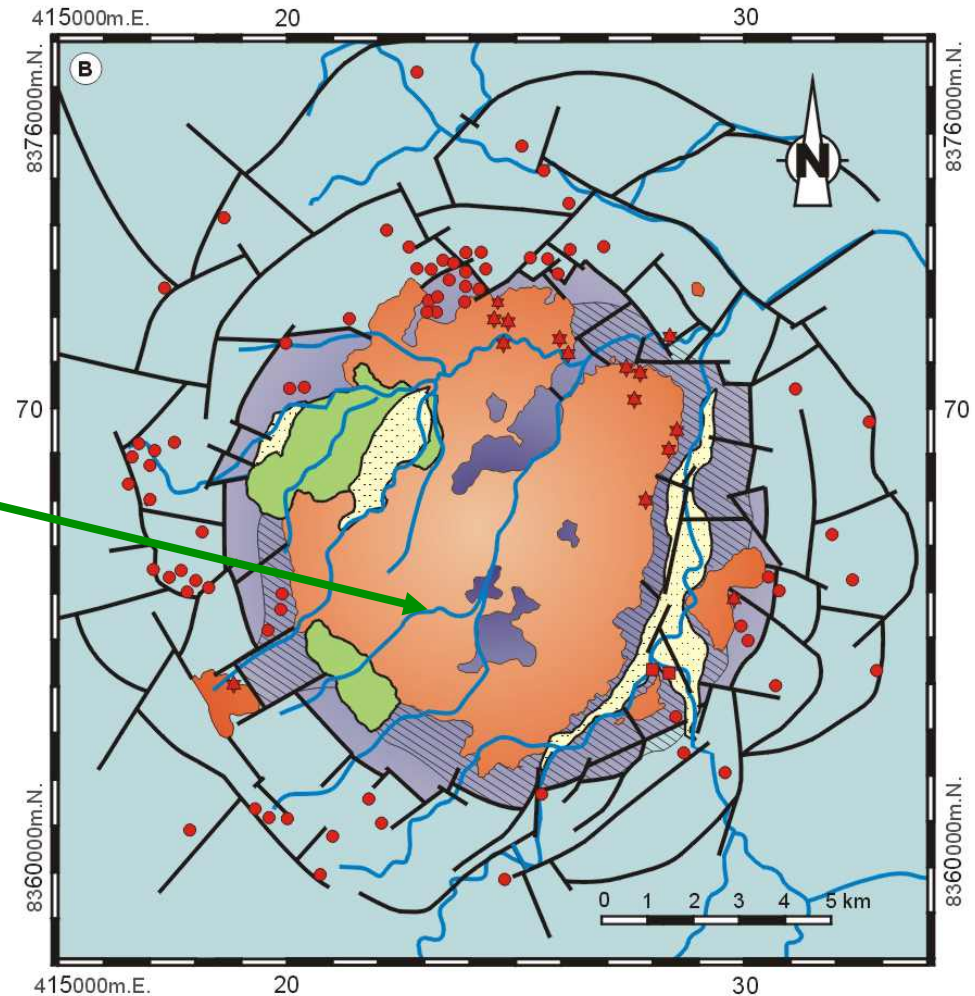
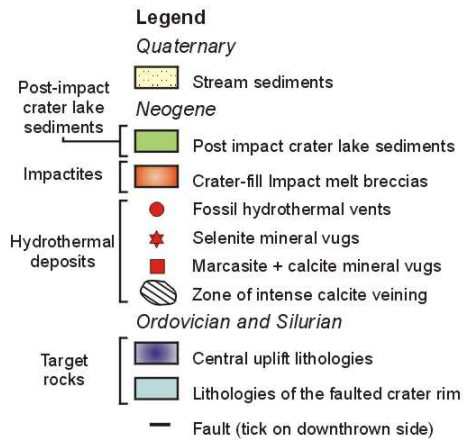




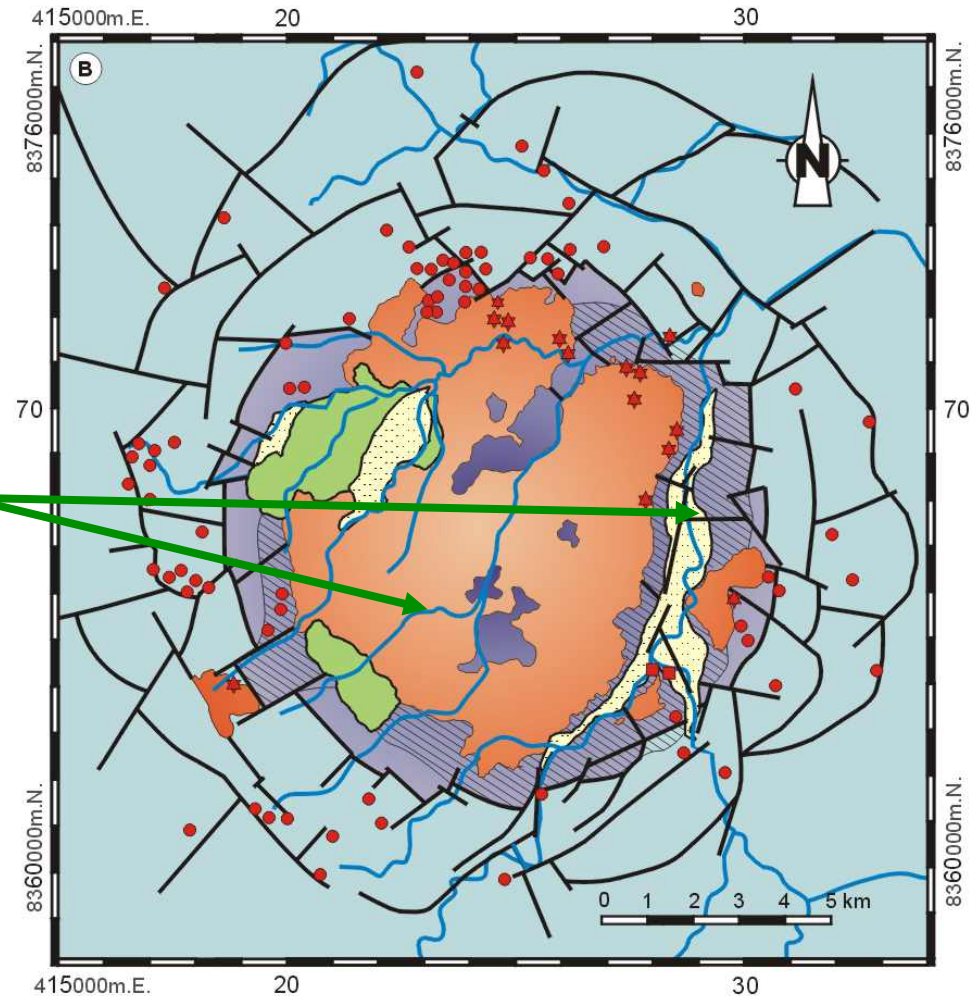
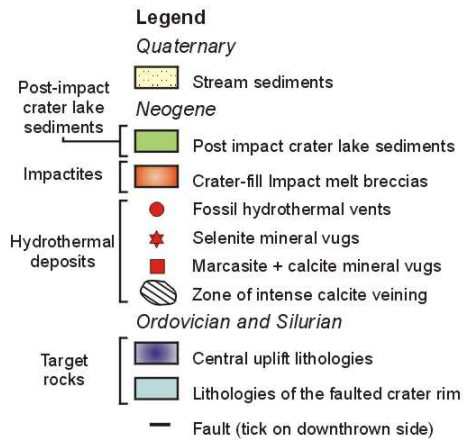




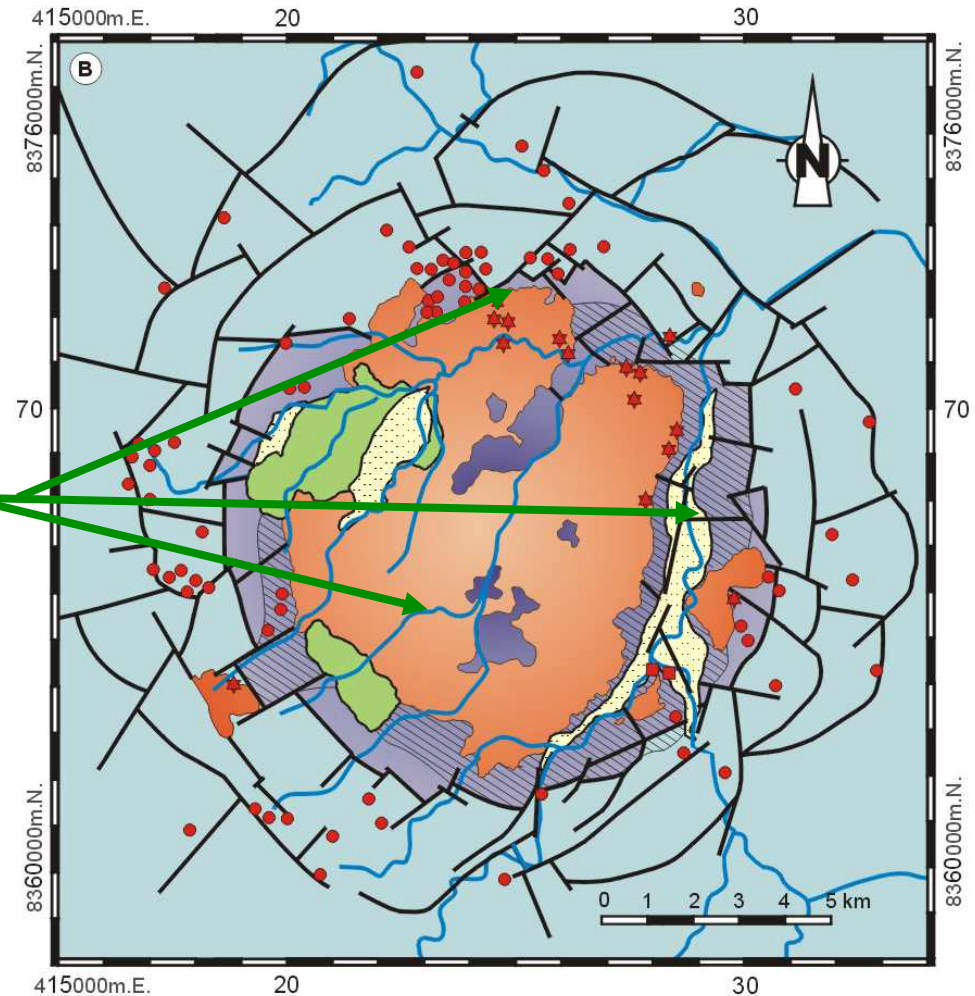
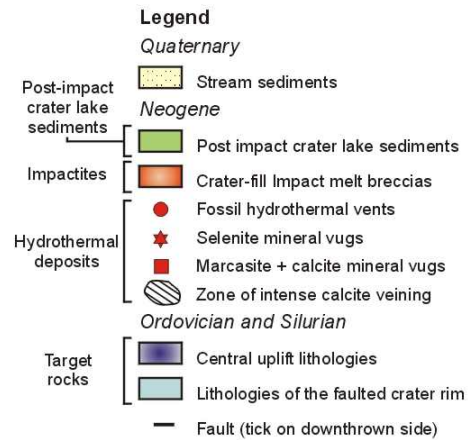
Hydrothermal activity at Haughton



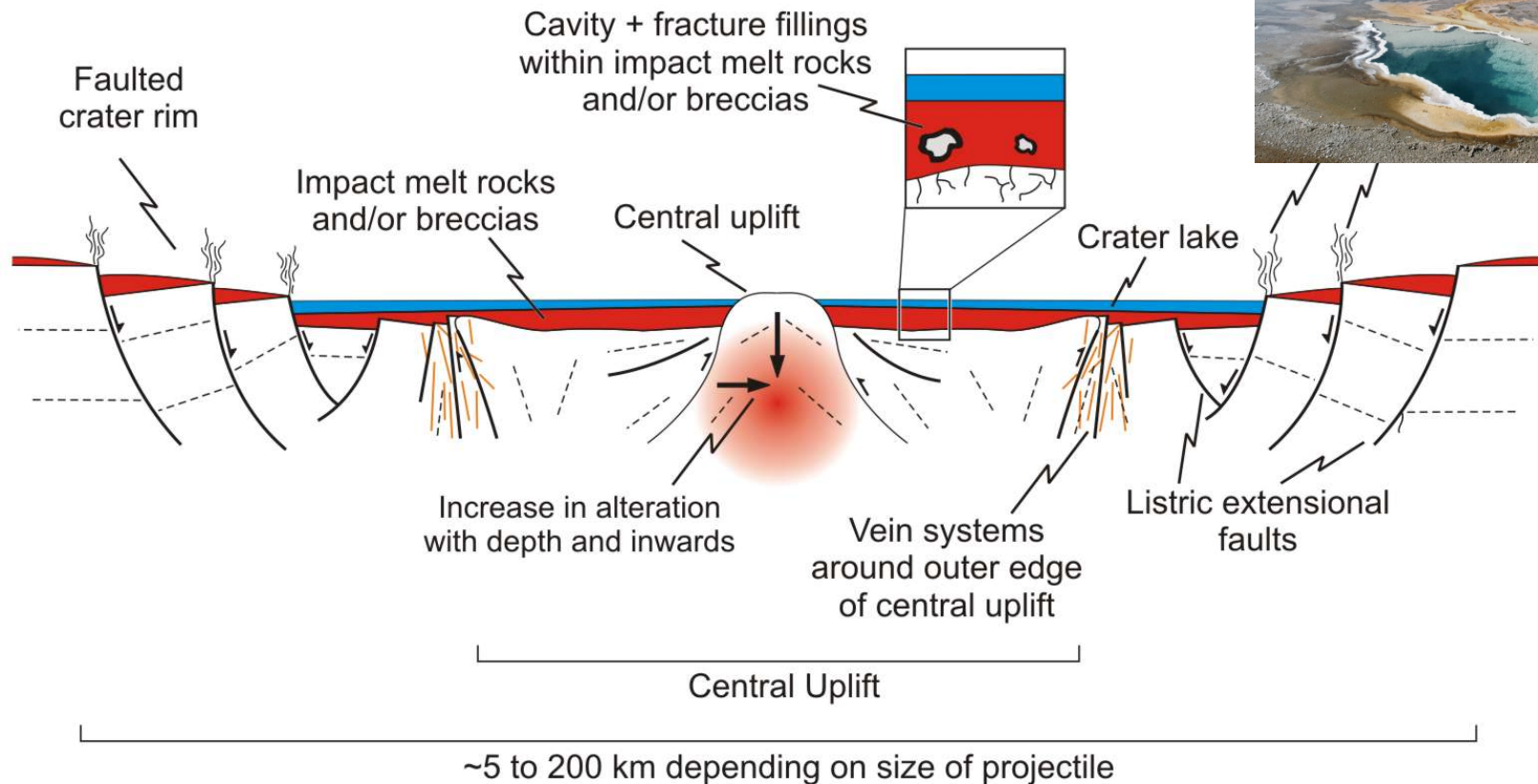
Hydrothermal activity at Haughton



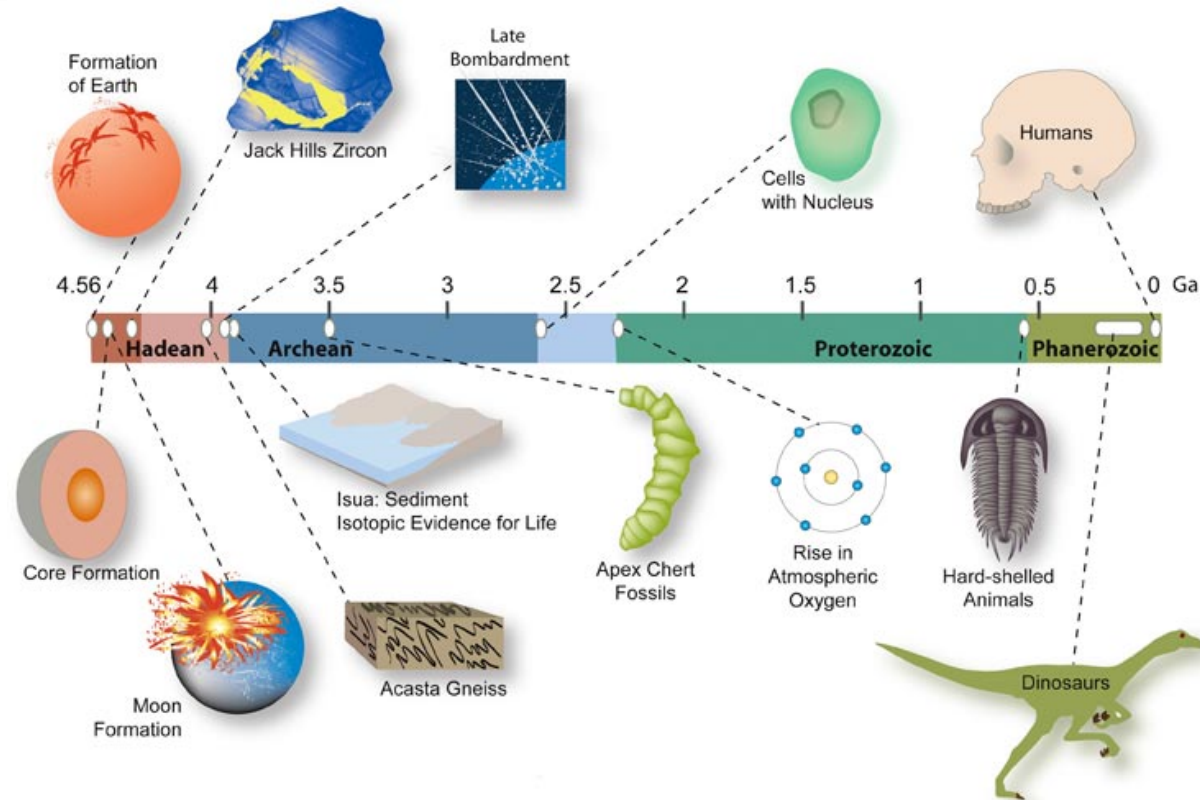
Hydrothermal activity at Haughton



Impact-induced hydrothermal systems



Origin of life on Earth...

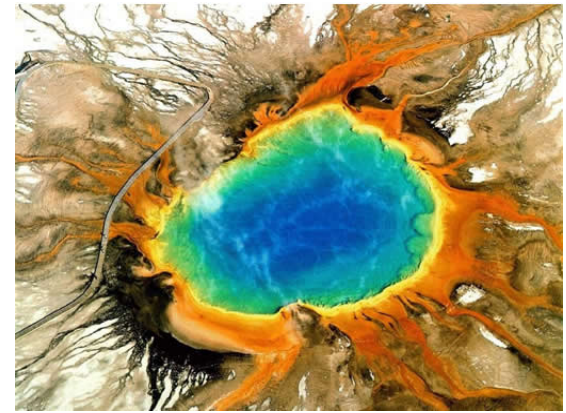
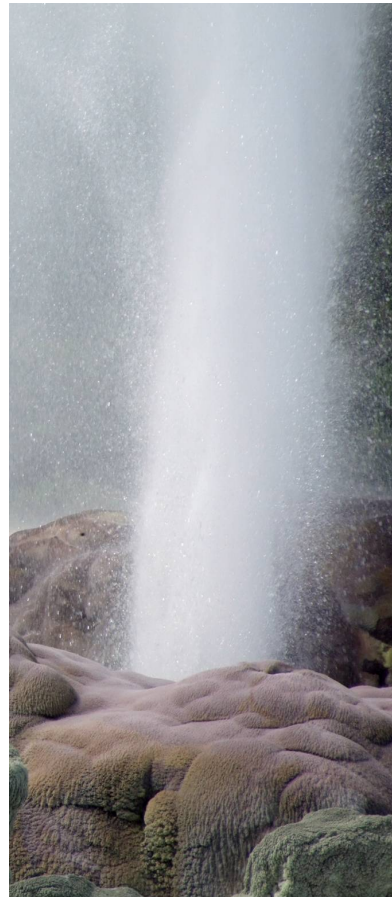


- First geochemical evidence for life: **~3.8 Ga.**
- Lunar craters: impacts **~10–20** times more common **~3.8 Ga** than they are now.
- Why should (and how did) life evolve at the harshest, most inhospitable time in Earth's history?

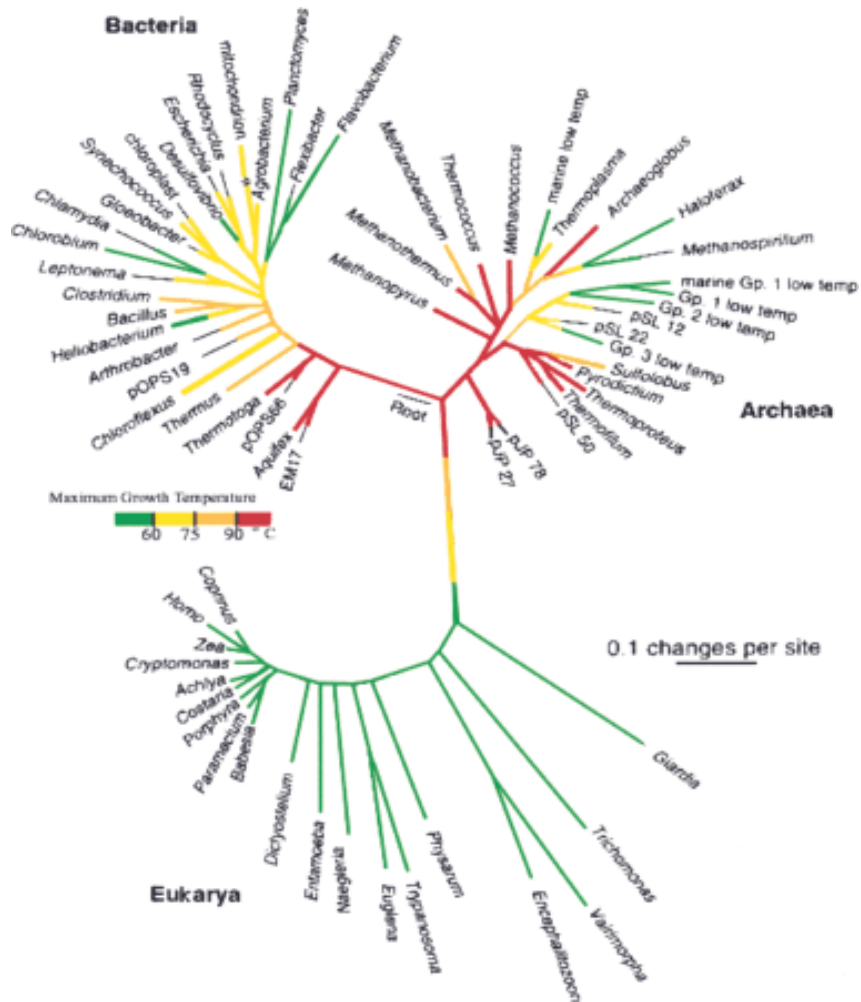
Where did life originate?

*“If we could conceive in some **warm little pond**, with all sorts of ammonia and phosphoric salts, light, heat, electricity present, that a protein compound was chemically formed, ready to undergo still more complex changes. At the present day, such matter would be instantly devoured or absorbed, which would not have been the case before living creatures were formed.”*

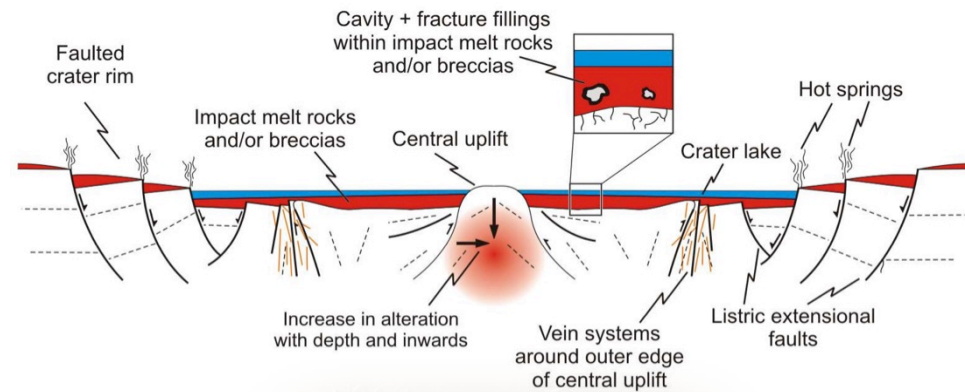
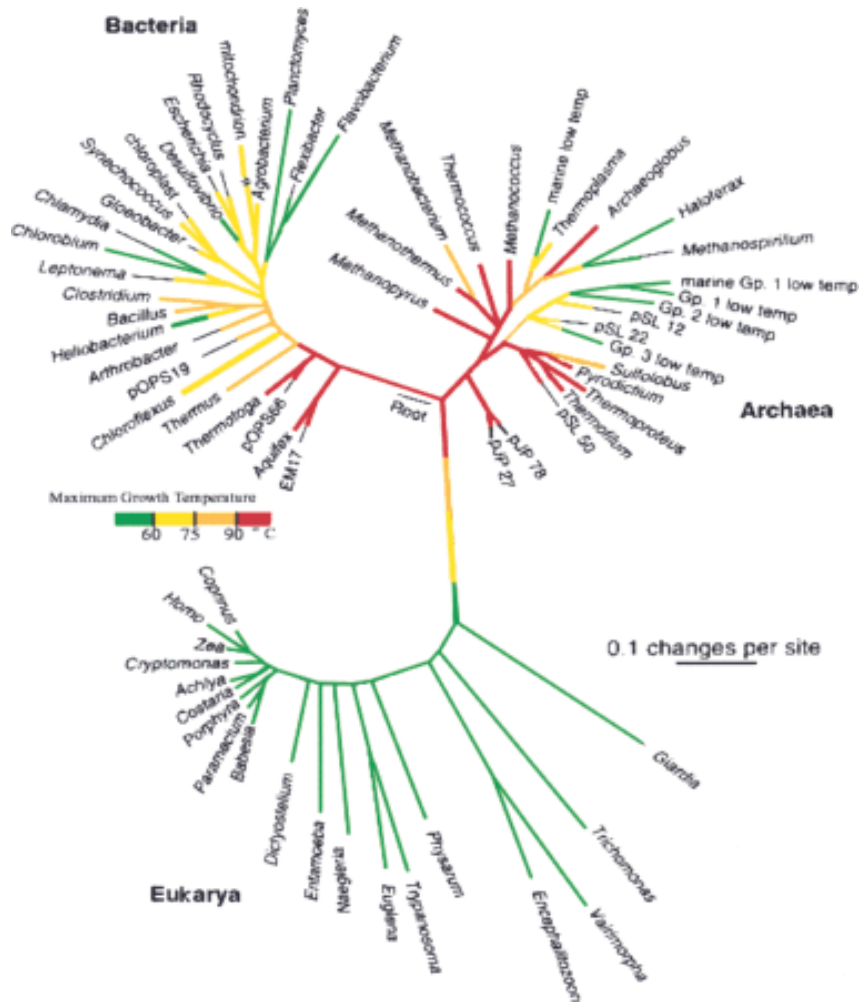
Charles Darwin, *The Origin of Species*
(1871)



A hydrothermal origin of life?



A hydrothermal origin of life?



Questions?

